LEAMINGTON BURN STUDIES - SPECIAL PROJECTS

Introduction

In 1996, Utah experienced its most active, extensive, and devastating fire season. In Millard and Juab Counties alone, some 250,000 acres were burned. The Leamington Complex was the largest burned area covering approximately 138,340 acres of mostly pinyon-juniper woodland. Rehabilitation efforts began in the fall of 1996 which included drilling the more accessible low-lying areas, and then the remainder was aerially seeded and chained one-way to cover the seed. On the Leamington Complex, about 6,100 acres were treated with a rangeland drill, 10,736 acres were aerially seeded and followed by a one-way chaining with an Ely chain to help cover the seed, and 8,308 acres were aerially seeded only. Aerially seeding and then chaining is an effective method of breaking up burned trees which provide valuable surface litter to help protect the soil from erosion, as well as enhancing seedling establishment by covering the seed. This practice was stopped temporarily because of concerns voiced by environmental and Native American groups with regard to archeological resources in the burned areas even though an archeological survey had been completed. During the summer of 1997, two permanent range trend study sites were placed; one located in a burned and seeded area, and the other established in the immediate area where it had been burned, seeded, then chained one-way. The purpose of these sites was to monitor any differences in secondary succession and seedling establishment on these two treatments. Four (2 paired sites) additional trend studies were established in 1998. Data summaries from these sites are found in this section including study site maps, data tables and a text narrative.

Seed Lists

Leamington Burn (21-10) and Leamington Burn & Chain (21-21) sites occur within the Little Sage chaining treatment area which included approximately 3,765 acres. The seed mix for the area is listed below.

Aerial Mix

Species	Pounds of Seed	Pounds per acre
High Crest (*Agropyron cristatum*)	12,450	3.3
Rye (*Elymus junceus*)	12,450	3.3
Tall wheatgrass (*Agropyron elongatum*)	8,300	2.2
Great Basin Wildrye (*Elymus cinereus*)	2,000	0.53
Smooth brome (*Bromus inermis*)	600	0.16
Alfalfa (*Medicago sativa*)	1,200	0.32
Small burnet (*Sanguisorba minor*)	500	0.13

Dribbler Mix

Fourwing saltbush (*Atriplex canescens*)	3,700	1.0

Seed list for Paul Bunyon Burn (19B-19) and Paul Bunyon Burn & Chain (19B-20). Total treatment area is approximately 3,779 acres.

Aerial Mix

Species	Pounds of Seed	Pounds per acre
High Crest (*Agropyron cristatum*)	15,100	4.0
Rye (*Elymus junceus*)	11,350	3.0
Tall wheatgrass (*Agropyron elongatum*)	7,500	2.0

Dribbler Mix

Fourwing saltbush (*Atriplex canescens*)	3,800	1.0

Seed list for Jericho State Section 19B-21. Treatment area included approximately 1,200 acres.

Aerial Mix

Species	Pounds per acre
High Crest (*Agropyron cristatum*)	5.0
Intermediate Wheatgrass (*Agropyron intermedium*)	3.0
Alfalfa (*Medicago sativa*)	1.0
Yellow Sweet Clover (*Melilotus officinalis*)	0.5

Seed list for Jericho BLM 19B-22. Treatment area included approximately 2,131 acres.

Aerial Mix

Species	Pounds of Seed	Pounds per acre
High Crest (*Agropyron cristatum*)	6,550	3.1
Rye (*Elymus junceus*)	4,400	2.1
Tall wheatgrass (*Agropyron elongatum*)	4,250	2.0
Smooth Brome (*Bromus inermis*)	4,000	1.9

Dribbler Mix

Fourwing saltbush (*Atriplex canescens*)	2,150	1.0

Trend Study 19B-19-98

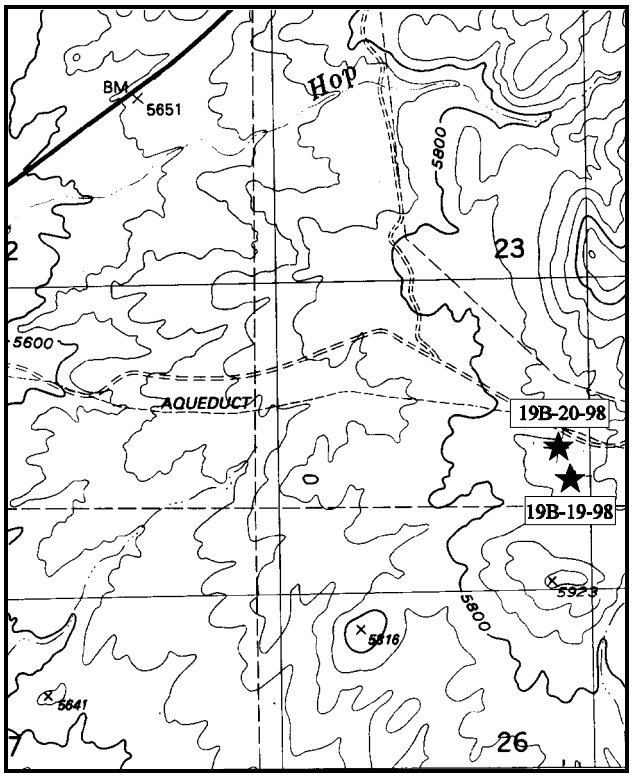
Study site name: Paul Bunyon Burn . Range type: Burn and Seeded

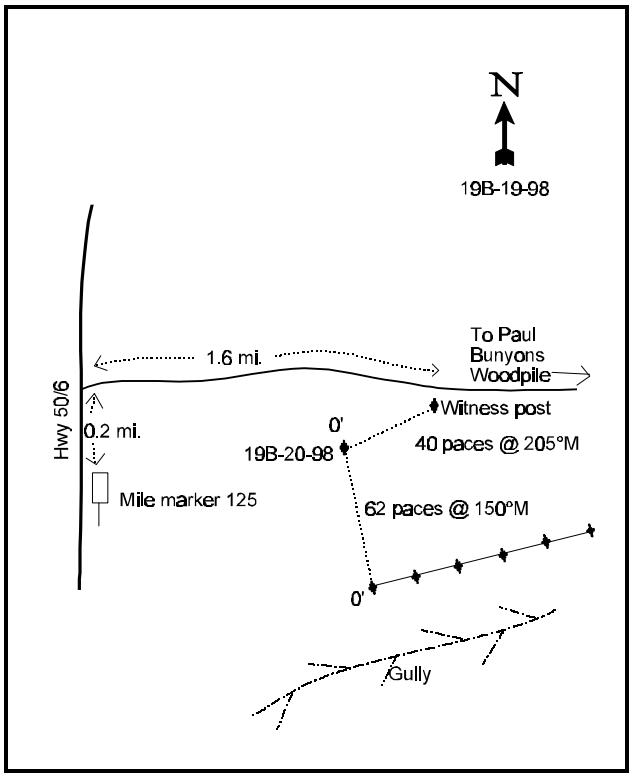
Compass bearing: frequency baseline 68 M degrees.

Footmark (first frame placement) 5 feet. Frequency belt placement; line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft).

LOCATION DESCRIPTION

From Hwy 50/6 go 0.2 miles north of mile marker 125. Turn right heading toward the Paul Bunyon Woodpile. Drive 1.6 miles to a four foot tall witness post on the right side of the road. The 0-foot stake for study 19B-20 is 40 paces at 205°M. The 0-foot stake for 19B-19 is 62 paces at 150°M from the other sites 0-foot stake. The site is marked by short green fenceposts. The 0-foot stake is marked by browse tag # 66.





Map Name: McIntyre, Utah

Diagrammatic Sketch

Township 12S , Range 3W , Section 23

UTM 4401333.916 N, 401960.434 E

DISCUSSION

Trend Study No. 19B-19

This is a new trend study site established in 1998 to monitor a burned and seeded pinyon-juniper area similar to the Leamington Burn site mentioned earlier (# 21-20). This site, Paul Bunyon Burn, and the adjacent Paul Bunyon Burn and Chained site (19B-20) are also part of the extensive Leamington burn complex which burned approximately 138,340 acres of mostly pinyon-juniper rangelands. Rehabilitation efforts were started during the fall of 1996 and included drilling, chaining, and seeding. This site samples a burned site that was aerially seeded and not chained. A nearby burned area that was aerially seeded then chained is sampled by study # 19B-20 to contrast the difference between the two treatments. The Paul Bunyon Burn site has a west aspect with a gentle slope of 8 to 10%. Elevation is approximately 5,900 feet. Pellet group data indicates little use of the area by deer with only one pellet group found. Rabbit sign was fairly common.

Soil at the site is moderately deep with an effective rooting depth estimated at 14 inches. Soil texture is a sandy clay loam with a neutral pH (7.0). Rock is not abundant on the surface at only 3% cover, but pavement is common with a high cover value of 32%. Rock index data shows that most rocks are concentrated under the surface between 4 and 12 inches in depth. Due to the sandy texture of the soil, combined with high surface pavement cover, average soil temperature is high at 70°F at a depth of almost 16 inches. Bare soil is common with a cover value of 40%. It is most common under burned juniper trees where little vegetation of any kind is found. Some erosion is occurring on the site but it is localized and not severe.

Before the 1996 fire, this site was dominated by juniper trees. Point quarter data on dead trees estimated a density of 331 trees/acre. Most of these were large older trees and average trunk diameter is estimated at 7.6 inches. A few sagebrush occurred prior to the burn but density was low. The only browse found on the site after the fire is a few seeded fourwing saltbush plants.

Grasses provide most of the vegetative cover on the site, but cheatgrass is the most abundant species providing a total of almost 13% cover which equates to 76% of the grass cover. The only common perennial species are seeded crested wheatgrass and Russian wildrye which combine to produce just over 3% cover. Seeded grasses, tall wheatgrass and smooth brome, are present but rare. Native grasses are represented by small numbers of Indian ricegrass and bottlebrush squirreltail. These were likely depleted prior to the fire due to the high density of juniper trees. Grasses are vigorous with some of the seeded species growing to a height of 3 feet. Forbs are lacking and provide only 4% cover. Of the 7 annual and 6 perennial forbs encountered on the site, only prickly lettuce is abundant. No forbs were included within the aerial seed mix due to planned future spraying of the site to control noxious weeds.

1998 APPARENT TREND ASSESSMENT

There is a considerable amount of bare soil on the site, 40%, but erosion does not appear to be a problem due mostly in part to the lack of slope. The soil trend will likely improve as more herbaceous vegetation becomes established in the future. There is little browse on the site. The few fourwing saltbush encountered appear to be well established. The herbaceous understory is well established, but cheatgrass is dominant and provides 76% of the grass cover and 60% of the herbaceous cover. All of the seeded grasses contained in the seed mix are found on the site, however only crested wheatgrass and Russian wildrye occur more than occasionally. Native grasses, Indian ricegrass and bottlebrush squirreltail, are also present but rare. They were likely depleted prior to the fire due to the high juniper tree density (331 trees/acre). Forb composition is poor with weedy biennial and annual species providing most of the cover. This condition will likely improve in time.

HERBACEOUS TRENDS --
Herd unit 19B, Study no: 19

Type	Species	Nested Frequency '98	Quadrat Frequency '98	Average Cover % '98
G	Agropyron cristatum	58	25	1.64
G	Agropyron elongatum	7	3	.33
G	Bromus inermis	-	-	.00
G	Bromus tectorum (a)	268	79	12.52
G	Elymus junceus	27	9	1.49
G	Oryzopsis hymenoides	4	2	.21
G	Sitanion hystrix	2	1	.38
Total for Annual Grasses		268	79	12.52
Total for Perennial Grasses		98	40	4.06
F	Alyssum alyssoides (a)	45	19	.26
F	Argemone munita	-	-	.30
F	Astragalus spp.	3	2	.01
F	Carduus nutans (a)	2	1	.00
F	Chaenactis douglasii	11	5	.24
F	Cruciferae	10	5	.24
F	Descurainia pinnata (a)	8	3	.18
F	Eriogonum cernuum (a)	16	7	.23
F	Lactuca serriola	68	36	2.51
F	Lesquerella spp.	-	-	.00
F	Nicotiana attenuata (a)	-	-	.00
F	Salsola iberica (a)	1	1	.01
F	Sisymbrium altissimum (a)	4	2	.31
Total for Annual Forbs		76	33	1.02
Total for Perennial Forbs		92	48	3.32

BROWSE TRENDS --
Herd unit 19B, Study no: 19

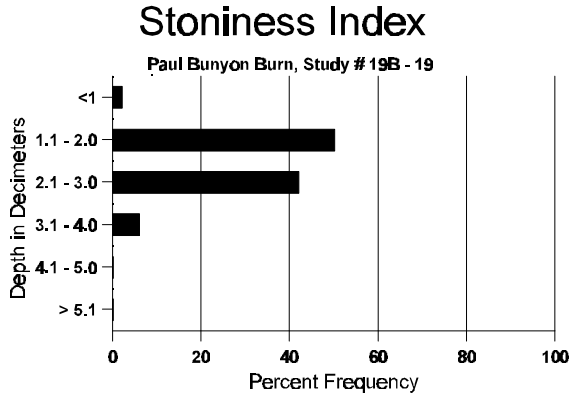
Type	Species	Strip Frequency '98	Average Cover % '98
B	Artemisia tridentata wyomingensis	0	-
B	Atriplex canescens	2	.03
B	Juniperus osteosperma	0	-
Total for Browse		2	0.03

BASIC COVER --
Herd unit 19B, Study no: 19

Cover Type	Nested Frequency '98	Average Cover % '98
Vegetation	312	21.67
Rock	182	3.33
Pavement	461	32.45
Litter	460	15.95
Bare Ground	415	39.84

SOIL ANALYSIS DATA --
Herd Unit 19B, Study # 19, Study Name: Paul Bunyon Burn

Effective rooting depth (inches)	Temp °F (depth)	pH	%sand	%silt	%clay	%0M	PPM P	PPM K	dS/m
14.0	70.0 (15.5)	7.0	48.7	24.7	26.6	2.7	11.6	115.2	.6



PELLET GROUP FREQUENCY --
Herd unit 19B, Study no: 19

Type	Quadrat Frequency '98
Rabbit	11
Deer	1

BROWSE CHARACTERISTICS --
Herd unit 19B, Study no: 19

AGE	YR	Form Class (No. of Plants) 1 2 3 4 5 6 7 8 9	Vigor Class 1 2 3 4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Artemisia tridentata wyomingensis							
X	98	- - - - - - - - -	- - - -	20			1

% Plants Showing '98	Moderate Use	Heavy Use	Poor Vigor	%Change
	00%	00%	00%	

Total Plants/Acre (excluding Dead & Seedlings) '98 0 Dec: -

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Atriplex canescens																		
Y	98	-	-	1	-	-	-	-	-	-	1	-	-	-	20			1
M	98	1	-	-	-	-	-	-	-	-	1	-	-	-	20	-	-	1
% Plants Showing '98				Moderate Use 00%			Heavy Use 50%				Poor Vigor 00%					%Change		
Total Plants/Acre (excluding Dead & Seedlings)													'98		40	Dec:		-
Juniperus osteosperma																		
X	98	-	-	-	-	-	-	-	-	-	-	-	-	-	380			19
% Plants Showing '98				Moderate Use 00%			Heavy Use 00%				Poor Vigor 00%					%Change		
Total Plants/Acre (excluding Dead & Seedlings)													'98		0	Dec:		-

Trend Study 19B-20-98

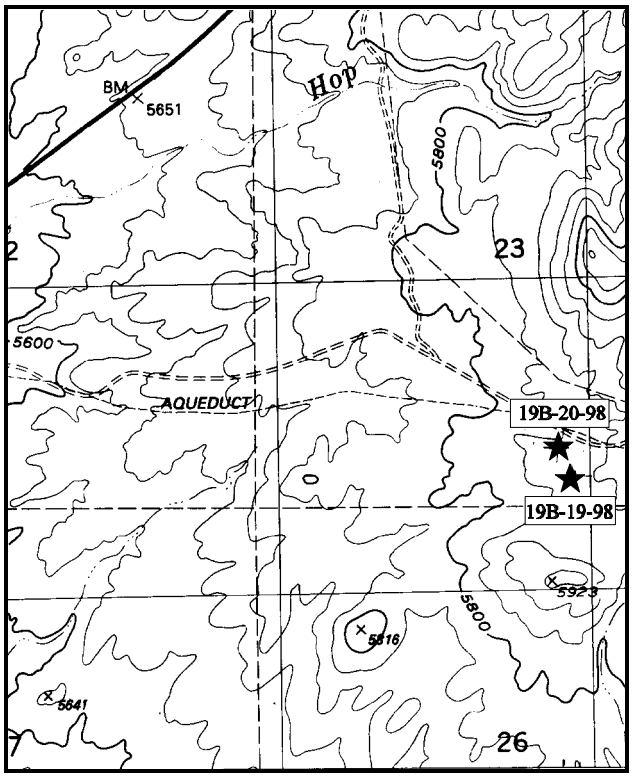
Study site name: Paul Bunyon Burn . Range type: Burn and Seeded

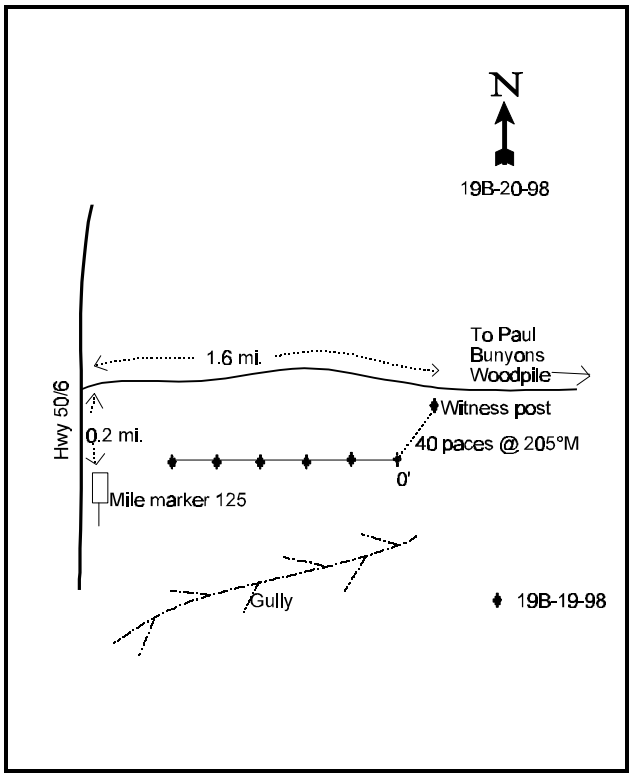
Compass bearing: frequency baseline 268 M degrees.

Footmark (first frame placement) 5 feet. Frequency belt placement; line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft).

LOCATION DESCRIPTION

From Hwy 50/6 go 0.2 miles north of mile marker 125. Turn right heading toward the Paul Bunyon Woodpile. Drive 1.6 miles to a four foot tall witness post on the right side of the road. The 0-foot stake for this study is 40 paces at 205°M from the witness post. The site is marked by short green fenceposts. The 0-foot stake is marked by browse tag # 74.





Map Name: McIntyre, Utah

Diagrammatic Sketch

Township 12S , Range 3W , Section 23

UTM 4401419.791 N, 401929.871 E

DISCUSSION

Trend Study No. 19B-20

This study, the Paul Bunyon Burn & Chain trend study site, was placed approximately 300 feet northwest of the Paul Bunyon Burn site (# 19B-19). Seed was aerially applied and then this site was chained one-way with an Ely chain to help cover the seed and enhance establishment of seeded species. It has a western aspect with a gentle slope of 5%. Elevation is approximately 5,900 feet. The pellet group transect found no deer sign but rabbit pellets were found in moderately high numbers.

Soil on this site is very similar to the adjacent Paul Bunyon Burn site (# 19B-19). Effective rooting depth is estimated at 14 inches. Soil texture is a sandy clay loam with a neutral pH (7.0). Percent phosphorus is lower at just 8.9 ppm which may be limiting to plant development. Vegetative, litter, and rock cover on the soil surface is similar to the unchained site, although pavement cover is much lower, 17% compared to 32%. Bare ground is much higher at 50% compared to 40% on the burned only site. This is mostly due to the chaining treatment which roughed up the soil surface. There is little sign of erosion.

Seeded fourwing saltbush was applied from a seed dribbler which dropped seed over the tracks of the bulldozers as they pulled the chain over the site. They have become well established and are vigorous with an estimated density of 280 plants/acre. A few stickyleaf low rabbitbrush were also encountered on the site.

The herbaceous understory has established well after the fire with 5 perennial and one annual grass providing 19% ground cover. Seeded grasses have established much better here compared to the adjacent unchained site. Nest frequency of seeded grasses is 3 times higher and cover is 4 times greater. Crested wheatgrass is the most abundant perennial grass, providing 38% of the grass cover. Tall wheatgrass and Russian wildrye are also common and account for 14% and 20% of the grass cover respectively. Native grasses are represented by small numbers of bluebunch wheatgrass and bottlebrush squirreltail. Nested frequency of these species is twice as high as the unchained site. Cheatgrass has very similar nested frequency values compared to the unchained site (270 on the chained site versus 268 on the unchained site), but cover is nearly 3 times lower (4.4% vs 12.5%). Cheatgrass plants are much smaller due to the competition with seeded perennial grasses. It currently accounts for only 23% of the grass cover.

Forbs are lacking on the chained site likely due to the same competition which appears to be keeping cheatgrass in check. Total forb cover is actually higher on the unchained site, but composition is similar and only prickly lettuce and tumble mustard are common.

1998 APPARENT TREND ASSESSMENT

Percent bare ground is abundant, but significant erosion does not appear to be occurring. Vegetation cover is well dispersed and consists mostly of perennial grass cover. The soil trend will continue to improve as more herbaceous vegetation becomes established. The seeded fourwing saltbush has established well with a density of 280 plants/acre. These are vigorous and age class composition indicates an expanding population with a biotic potential of 7% and young plants accounting for half of the population. The herbaceous understory is well established and will most likely increase in the future. Perennial seeded grasses are abundant and robust. Native grasses are also present in small numbers. Cheatgrass has similar nested frequency values compared to the unchained site, but cover is one-third lower (12.5% vs 4.4%). The vigorous perennial grasses appear to be suppressing cheatgrass. Forbs are infrequent with a similar poor composition compared to the unchained site. Composition will likely change in the future with some of the weedy species dying out, however there will probably never be a good forb component due to the lack of an adequate seed bank. Forbs were not included in the seeding mix because of the possibility of future spraying to kill noxious weeds.

HERBACEOUS TRENDS --
Herd unit 19B, Study no: 20

Type	Species	Nested Frequency '98	Quadrat Frequency '98	Average Cover % '98
G	Agropyron cristatum	133	52	7.22
G	Agropyron elongatum	52	24	2.69
G	Agropyron spicatum	9	3	.56
G	Bromus tectorum (a)	270	84	4.39
G	Elymus junceus	78	32	3.87
G	Sitanion hystrix	4	3	.21
Total for Annual Grasses		270	84	4.39
Total for Perennial Grasses		276	114	14.56
F	Alyssum alyssoides (a)	13	5	.19
F	Astragalus spp.	10	4	.09
F	Calochortus nuttallii	2	1	.00
F	Chaenactis douglasii	4	2	.03
F	Cryptantha spp.	3	1	.00
F	Gilia spp. (a)	3	1	.00
F	Lactuca serriola	35	19	.58
F	Lesquerella spp.	1	1	.01
F	Lomatium spp.	3	1	.03
F	Phlox hoodii	2	1	.00
F	Salsola iberica (a)	1	1	.03
F	Sisymbrium altissimum (a)	20	12	.32
F	Streptanthus cordatus	9	3	.06
Total for Annual Forbs		37	19	0.55
Total for Perennial Forbs		69	33	0.83

BROWSE TRENDS --
Herd unit 19B, Study no: 20

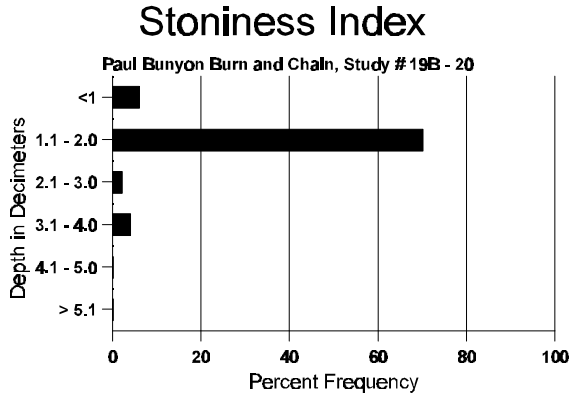
Type	Species	Strip Frequency '98	Average Cover % '98
B	Artemisia tridentata wyomingensis	0	-
B	Atriplex canescens	14	.63
B	Chrysothamnus viscidiflorus viscidiflorus	1	-
B	Juniperus osteosperma	0	-
Total for Browse		15	0.63

BASIC COVER --
Herd unit 19B, Study no: 20

Cover Type	Nested Frequency '98	Average Cover % '98
Vegetation	345	21.46
Rock	207	4.19
Pavement	446	17.03
Litter	465	13.75
Bare Ground	469	49.65

SOIL ANALYSIS DATA --
Herd Unit 19B, Study # 20, Study Name: Paul Bunyon Burn and Chain

Effective rooting depth (inches)	Temp °F (depth)	pH	%sand	%silt	%clay	%0M	PPM P	PPM K	dS/m
13.9	69.0 (14.5)	7.0	48.4	25.1	26.6	2.7	8.9	134.4	.6



PELLET GROUP FREQUENCY --
Herd unit 19B, Study no: 20

Type	Quadrat Frequency '98
Rabbit	3

BROWSE CHARACTERISTICS --
Herd unit 19B, Study no: 20

AGE	YR	Form Class (No. of Plants) 1 2 3 4 5 6 7 8 9	Vigor Class 1 2 3 4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Artemisia tridentata wyomingensis							
X	98	- - - - - - - - -	- - - -	120			6

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor	%Change
'98	00%	00%	00%	

Total Plants/Acre (excluding Dead & Seedlings) '98 0 Dec: -

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Atriplex canescens																		
S	98	1	-	-	-	-	-	-	-	-	1	-	-	-	20			1
Y	98	7	-	-	-	-	-	-	-	-	7	-	-	-	140			7
M	98	7	-	-	-	-	-	-	-	-	7	-	-	-	140	31	35	7
% Plants Showing '98		Moderate Use 00%				Heavy Use 00%					Poor Vigor 00%					%Change		
Total Plants/Acre (excluding Dead & Seedlings)													'98		280	Dec:		-
Chrysothamnus viscidiflorus viscidiflorus																		
M	98	1	-	-	-	-	-	-	-	-	1	-	-	-	20	-	-	1
% Plants Showing '98		Moderate Use 00%				Heavy Use 00%					Poor Vigor 00%					%Change		
Total Plants/Acre (excluding Dead & Seedlings)													'98		20	Dec:		-
Juniperus osteosperma																		
X	98	-	-	-	-	-	-	-	-	-	-	-	-	-	360			18
% Plants Showing '98		Moderate Use 00%				Heavy Use 00%					Poor Vigor 00%					%Change		
Total Plants/Acre (excluding Dead & Seedlings)													'98		0	Dec:		-

SUMMARY

Site Comparisons Between Paul Bunyon Burn 19B-19 and Paul Bunyon Burn & Chain 19B-20

1998 Comparisons

Ground cover characteristics are similar in some categories but quite different with respect to pavement cover and percent bare ground. Pavement cover is very high at more than 32% on the unchained site (# 19B-19) compared to just 17% on the chained site (# 19B-20). The difference is due primarily to the ground disturbance caused by the Ely chain used on the chained site. This disturbance is also responsible for the much higher bare ground cover value on the chained site compared to the unchained site (50% vs 40%). However, erosion on these two sites is localized and not currently a problem.

Shrubs are nearly absent from the burned site and consist of a few scattered fourwing saltbush (40 plants/acre). The chained site has a much higher density of the seeded fourwing saltbush estimated at 280 plants/acre. Half of these are young plants.

Vegetation cover on the two sites is very similar at around 21%. The composition of the cover is very different however. Seeded grasses established better on the Paul Bunyon Burn site than on the previously discussed Leamington Burn (# 21-20) site. However, cover is low at only 3.5% and the sum of nested frequency is only 92. The Paul Bunyon Burn & Chained site has a cover value 4 times higher for seeded grasses at almost 14% and a sum of nested frequency 3 times more than the unchained site at 263. Native grasses are lacking on both sites partly due to the dominance of juniper trees prior to the burn where their population was estimated at 331 trees/acre with an average diameter of 7.6 inches. At this density there were few residual native grasses with a correspondingly poor seed bank. Sum of nested frequency of native grasses was low on the chained site but it was twice that compared to the unchained site. Cover values were similar for both sites.

The forb composition is poor for both sites and no forbs were included in the seed mix. Sum of nested frequency and cover are higher on the unchained site due primarily to the lack of competition with perennial grasses. Most of the common species are annuals or weedy biennials.

Trend Study 19B-21-98

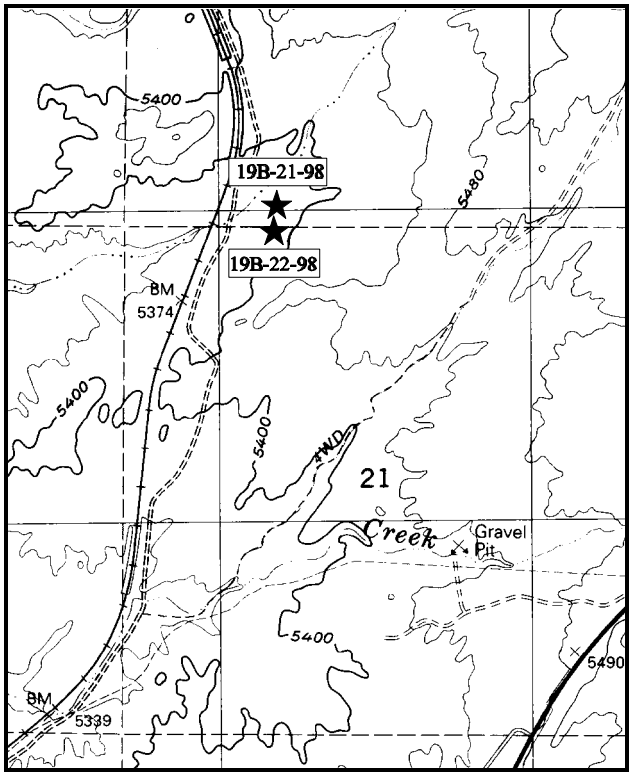
Study site name: Jericho State Section . Range type: Burn

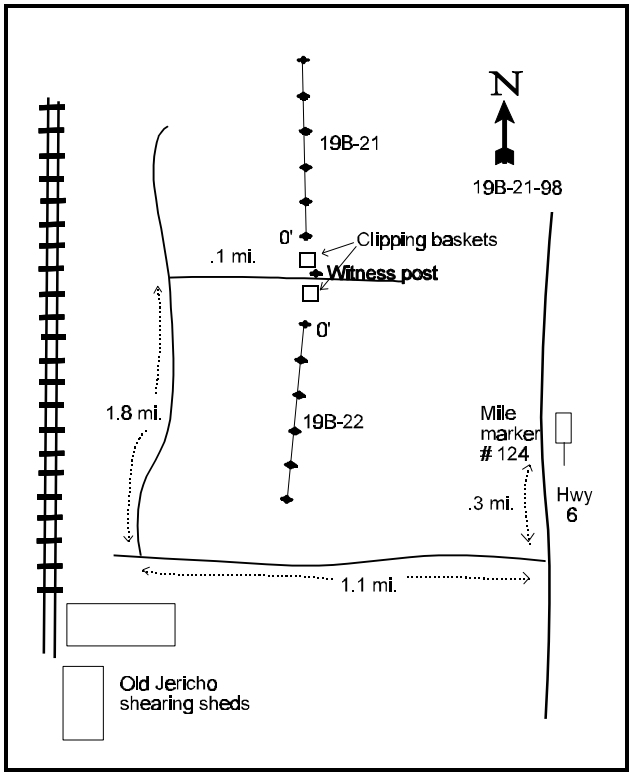
Compass bearing: frequency baseline 0 M degrees.

Footmark (first frame placement) 5 feet. Frequency belt placement; line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft).

LOCATION DESCRIPTION

From mile marker 124 on highway 6, drive 0.3 miles south to a road heading west. Take this road for 1.1 miles to the old Jericho shearing sheds on the left and an intersection before the railroad tracks. Turn right and follow the road on the east side of the tracks for 1.8 miles. At this point is the border of state land and BLM land. Turn right and follow the faint road along the border for 0.1 miles to a witness post and some clipping baskets. The 0-foot stake is 100 feet directly north of the witness post.





Map Name: McIntyre, Utah

Diagrammatic Sketch

Township 12S , Range 3W , Section 16

UTM 4403001.852 N, 398199.220 E

DISCUSSION

Trend Study No. 19B-21

This new site, Jericho State Section, is located in the Tintic Valley west of U.S. Highway 6 north of the old Jericho sheep shearing sheds. It samples a burned sagebrush flat just east of the railroad tracks. The area was also part of the extensive Leamington burn of 1996. It is nearly level with a slight southwest aspect. Elevation is approximately 5,400 feet. The site once supported a dense stand of basin big sagebrush. Burned sagebrush stems, counted in 1998, provide an estimated pre-burn density of 5,600 plants/acre. The fire burned very hot because the only evidence of sagebrush was burned stems on the ground surface. Low hills surround the site which once contained a mixture of sagebrush and juniper. This study samples a section of land owned by the State of Utah that was aerially seeded with crested wheatgrass, intermediate wheatgrass, alfalfa, and yellow sweetclover after the fire (see seed list). The site was not chained to cover the seed. Pellet group data demonstrates little rabbit use and sign of only a few trespass cattle.

Soil on the site is fairly deep with an effective rooting depth (see methods) of 16 inches. Texture is a loam with very little rock or pavement on the surface. Rock is also uncommon in the soil profile. Soil temperature is quite high averaging 67°F at a depth of almost 18 inches. Phosphorus appears to be limiting at only 3.8 ppm when 10 ppm is thought to be minimal for normal plant growth and development. Bare ground is abundant averaging almost 57% over the site. The soil surface had large cracks present indicating the existence of shrink-swell clays. This surface characteristic likely enhanced the establishment some of seeded grasses and forbs by providing safe-sites for establishment. Erosion is not a problem on the site due to the abundant herbaceous cover combined with the level terrain. Some shallow gullies found on the site indicate some erosion in the past but these channels are now filled with grasses and forbs.

There are currently no shrubs on the site and none were included in the seeding mix. The herbaceous understory consists of nearly equal amounts of grass and forb cover (23% for grasses and 22% for forbs). Grass composition is dominated by seeded grasses, crested wheatgrass and intermediate wheatgrass, which provide 71% of the grass cover. The only other common grass is cheatgrass which accounts for 26% of the grass cover. Native grasses, Indian ricegrass and bottlebrush squirreltail, occur infrequently.

There are two annual and eight perennial forbs found on the site, however seeded forbs, yellow sweetclover and alfalfa, totally dominate the forb component by providing 94% of the forb cover. These plants are large and very vigorous. Grasshoppers were abundant on the site and had apparently selectively eaten all of the yellow sweetclover leaves while alfalfa was unutilized.

1998 APPARENT TREND ASSESSMENT

The soil is currently stable with no apparent erosion occurring. Trend for soil will improve with increased litter and vegetative cover. There are no shrubs on the site or in the general vicinity except on the adjacent Jericho BLM site (# 19B-21) which was seeded with fourwing saltbush. Shrubs will take many years to establish on the site due to a lack of a nearby seed source. The herbaceous understory is well established with an almost equal amount of grass and forb cover. Seeded grasses are abundant and will likely increase in the next few years until competition becomes more acute. The composition of forbs will likely change in a few years as yellow sweet clover, a short lived forb, becomes less abundant. However, alfalfa appears to be well established and should persist unless subjected to overutilization by livestock. The abundance of perennial grasses and forbs appears to be keeping cheatgrass suppressed. Nested frequency is fairly high at 247, but cover is only 6%.

HERBACEOUS TRENDS --
Herd unit 19B, Study no: 21

Type	Species	Nested Frequency '98	Quadrat Frequency '98	Average Cover % '98
G	Agropyron cristatum	250	78	9.84
G	Agropyron intermedium	159	58	6.69
G	Bromus tectorum (a)	247	69	5.99
G	Oryzopsis hymenoides	4	1	.03
G	Sitanion hystrix	18	10	.79
Total for Annual Grasses		247	69	5.99
Total for Perennial Grasses		431	147	17.36
F	Alyssum alyssoides (a)	13	4	.19
F	Astragalus spp.	3	1	.03
F	Descurainia pinnata (a)	3	1	.00
F	Erigeron spp.	2	2	.15
F	Melilotus officinalis	93	40	8.05
F	Medicago sativa	175	76	12.24
F	Phlox hoodii	2	1	.15
F	Phlox longifolia	2	1	.03
F	Potentilla gracilis	1	1	.15
F	Sisymbrium altissimum (a)	10	4	.49
F	Sphaeralcea coccinea	2	2	.03
Total for Annual Forbs		26	9	0.68
Total for Perennial Forbs		280	124	20.84

BROWSE TRENDS--
Herd unit 19B, Study no: 21

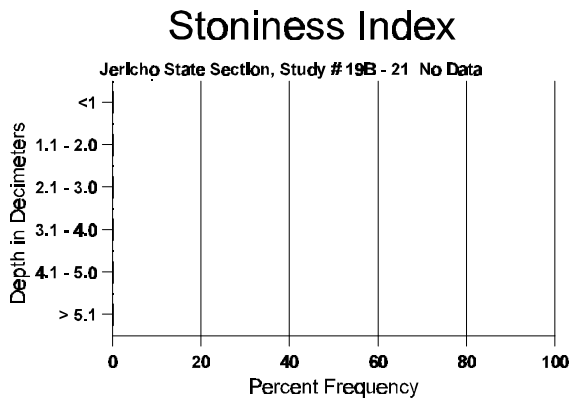
Species	Strip Frequency '98	Average Cover % '98
Artemisia tridentata tridentata	0	-
Opuntia spp.	0	-
Total for Browse	0	-

BASIC COVER --
Herd unit 19B, Study no: 21

Cover Type	Nested Frequency '98	Average Cover % '98
Vegetation	429	41.50
Rock	33	.13
Pavement	219	.80
Litter	468	10.19
Bare Ground	456	56.47

SOIL ANALYSIS DATA --
Herd Unit 19B, Study # 21, Study Name: Jericho State Section

Effective rooting depth (inches)	Temp °F (depth)	pH	%sand	%silt	%clay	%0M	PPM P	PPM K	dS/m
16.1	67.0 (17.5)	7.1	44.0	31.1	24.9	.9	3.8	278.4	.6



PELLET GROUP FREQUENCY --
Herd unit 19B, Study no: 21

Type	Quadrat Frequency '98
Rabbit	2

BROWSE CHARACTERISTICS --
Herd unit 19B, Study no: 21

AGE	YR	Form Class (No. of Plants) 1 2 3 4 5 6 7 8 9	Vigor Class 1 2 3 4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Artemisia tridentata tridentata							
X	98	- - - - - - - - -	- - - -	5600			280
% Plants Showing '98		Moderate Use 00%	Heavy Use 00%	Poor Vigor 00%		%Change	
Total Plants/Acre (excluding Dead & Seedlings)				'98	0	Dec:	-
Opuntia spp.							
X	98	- - - - - - - - -	- - - -	40			2
% Plants Showing '98		Moderate Use 00%	Heavy Use 00%	Poor Vigor 00%		%Change	
Total Plants/Acre (excluding Dead & Seedlings)				'98	0	Dec:	-

Trend Study 19B-22-98

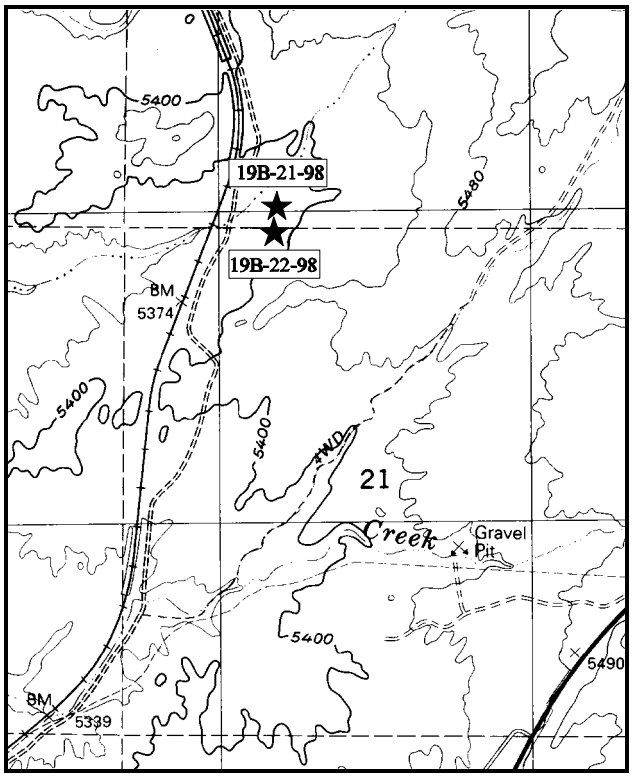
Study site name: Jericho BLM . Range type: Burn

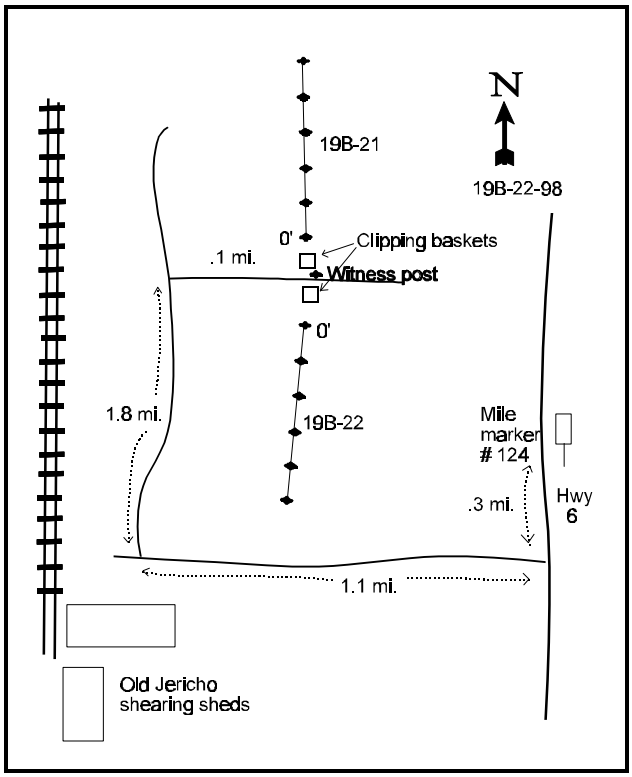
Compass bearing: frequency baseline 0 M degrees.

Footmark (first frame placement) 5 feet. Frequency belt placement; line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft).

LOCATION DESCRIPTION

From mile marker 124 on highway 6, drive 0.3 miles south to a road heading west. Take this road for 1.1 miles to the old Jericho shearing sheds on the left and an intersection before the railroad tracks. Turn right and follow the road on the east side of the tracks for 1.8 miles. At this point is the border of state land and BLM land. Turn right and follow the faint road along the border for 0.1 miles to a witness post and some clipping baskets. The 0-foot stake is 100 feet @ 192°M from the witness post. The 0-foot stake has browse tag #475.





Map Name: McIntyre, Utah

Diagrammatic Sketch

Township 12S , Range 3W , Section 16

UTM 4402944.546 N, 398179.270 E

DISCUSSION

Trend Study No. 19B-22

This trend study, Jericho BLM, samples the same sagebrush flat as study # 19B-21. The baseline begins about 200 feet south of the Jericho State Section baseline stake. Terrain is nearly level with a slight southwest aspect. Elevation is approximately 5,400 feet. This area was aerially seeded then one-way chained with an Ely chain to enhance establishment of seeded species. The seed mix (see seed list) consisted of 4 exotic perennial grasses and one shrub, fourwing saltbush. The fourwing seed was applied with a seed dribbler which dropped seeds on the bulldozer tracks during the chaining. The pellet group transect encountered only one deer pellet group and a few trespass cattle pats. No rabbit pellets were found.

Soil on this site is very similar to the unchained site 19B-21. Effective rooting depth (see methods) is estimated at almost 18 inches with little rock or pavement on the surface or within the profile. Soil texture is a loam with a neutral pH (7.3). Percent organic matter is two and one-half times higher than the unchained site. Phosphorus is low at only 4 ppm and may be limiting to plant growth and development where 10 ppm is considered minimal. Bare ground is abundant at 50%, yet there is no noticeable soil movement due to the abundant vegetative cover combined with the gentle terrain.

The site once supported a dense stand of big sagebrush. Counts of burned stems on this site estimate a lower density of pre-burn sagebrush (2,640 plants/acre), but the chaining obviously disturbed the ground surface enough to skew our sample. Currently, the seeded shrub, fourwing saltbush, has become established in fairly good numbers (400 plants/acre). Most (75%) of these were classified as young. Larger plants which were classified as mature, were not yet producing seed.

This site received a seed mix of only exotic perennial grasses which established very well. Tall wheatgrass is the most abundant followed by crested wheatgrass, Russian wildrye, and smooth brome. Cheatgrass is also common with a high nested frequency value of 334 and a quadrat frequency of 94%. However, cover value is only 10%, accounting for 29% of the grass cover. Cheatgrass occurs primarily in patches where perennial grasses did not become establish. Native grasses, Indian ricegrass and bottlebrush squirreltail, were both found on the site but only bottlebrush squirreltail is very abundant.

Forbs are rare with only 3 annual and 4 perennial species encountered. Annual forbs, pale alyssum and tumble mustard, provide nearly all of the forb cover (99%). Forbs will probably never be a significant component on this site unless seeded.

1998 APPARENT TREND ASSESSMENT

The soil trend appears stable with abundant and well dispersed vegetation cover. The trend will improve in the future as vegetation and litter cover increase. The only shrub on the site is seeded fourwing saltbush which appears to have established in sufficient numbers to maintain itself and probably increase in the future. Currently, there are an estimated 400 plants/acre, 75% of which were classified as young. The herbaceous understory is dominated by seeded perennial grasses which appear to be well established. Cheatgrass is present and occurs in dense patches, but only where perennial grasses did not establish in good numbers. Overall, cheatgrass accounts for 29% of the grass cover. It will likely not increase as long as the site is not overgrazed in the future. Forbs are scarce and the composition is poor with two annuals providing nearly all of the forb cover.

HERBACEOUS TRENDS --
Herd unit 19B, Study no: 22

Type	Species	Nested Frequency '98	Quadrat Frequency '98	Average Cover % '98
G	Agropyron cristatum	133	57	5.14
G	Agropyron intermedium	198	70	14.29
G	Bromus inermis	35	17	1.29
G	Bromus tectorum (a)	334	94	9.84
G	Elymus junceus	35	16	1.79
G	Oryzopsis hymenoides	-	-	.00
G	Sitanion hystrix	31	13	1.79
Total for Annual Grasses		334	94	9.84
Total for Perennial Grasses		432	173	24.32
F	Agoseris glauca	3	1	.00
F	Alyssum alyssoides (a)	87	30	.62
F	Calochortus nuttallii	2	1	.00
F	Descurainia pinnata (a)	4	1	.01
F	Senecio multilobatus	1	1	.00
F	Sisymbrium altissimum (a)	33	15	1.91
F	Sphaeralcea coccinea	-	-	.00
Total for Annual Forbs		124	46	2.54
Total for Perennial Forbs		6	3	0.01

BROWSE TRENDS --
Herd unit 19B, Study no: 22

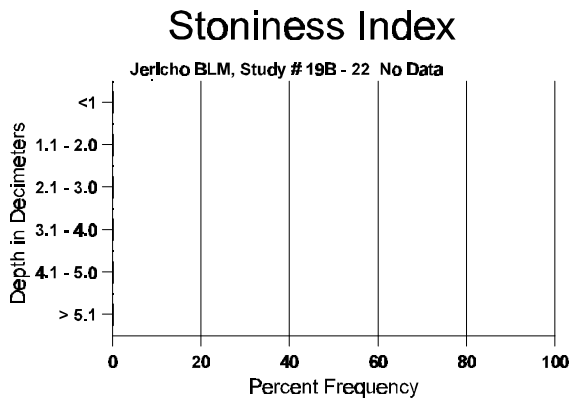
Type	Species	Strip Frequency '98	Average Cover % '98
B	Artemisia tridentata tridentata	0	-
B	Atriplex canescens	16	.33
Total for Browse		16	0.32

BASIC COVER --
Herd unit 19B, Study no: 22

Cover Type	Nested Frequency '98	Average Cover % '98
Vegetation	413	39.77
Rock	32	.11
Pavement	289	2.41
Litter	484	14.53
Bare Ground	459	49.61

SOIL ANALYSIS DATA --
Herd Unit 19B, Study # 22, Study Name: Jericho BLM

Effective rooting depth (inches)	Temp °F (depth)	pH	%sand	%silt	%clay	%0M	PPM P	PPM K	dS/m
17.5	67.4 (17.7)	7.3	44.0	30.1	25.9	2.5	4.0	364.8	.7



PELLET GROUP FREQUENCY --
Herd unit 19B, Study no: 22

Type	Quadrat Frequency '98
Rabbit	1

BROWSE CHARACTERISTICS --
Herd unit 19B, Study no: 22

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Artemisia tridentata tridentata																		
X	98	-	-	-	-	-	-	-	-	-	-	-	-	-	2640			132
% Plants Showing '98			Moderate Use 00%			Heavy Use 00%			Poor Vigor 00%						%Change			
Total Plants/Acre (excluding Dead & Seedlings)										'98	0	Dec:	-					
Atriplex canescens																		
Y	98	15	-	-	-	-	-	-	-	-	14	-	-	-	300			15
M	98	5	-	-	-	-	-	-	-	-	5	-	-	-	100	17	17	5
% Plants Showing '98			Moderate Use 00%			Heavy Use 00%			Poor Vigor 00%						%Change			
Total Plants/Acre (excluding Dead & Seedlings)										'98	400	Dec:	-					

Trend Study 21-20-98

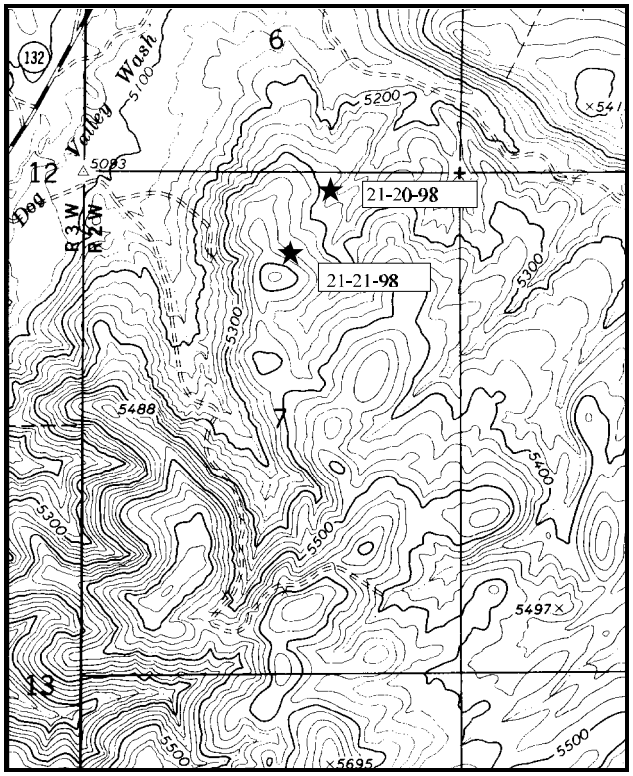
Study site name: Leamington Burn . Range type: Burned Pinyon-Juniper .

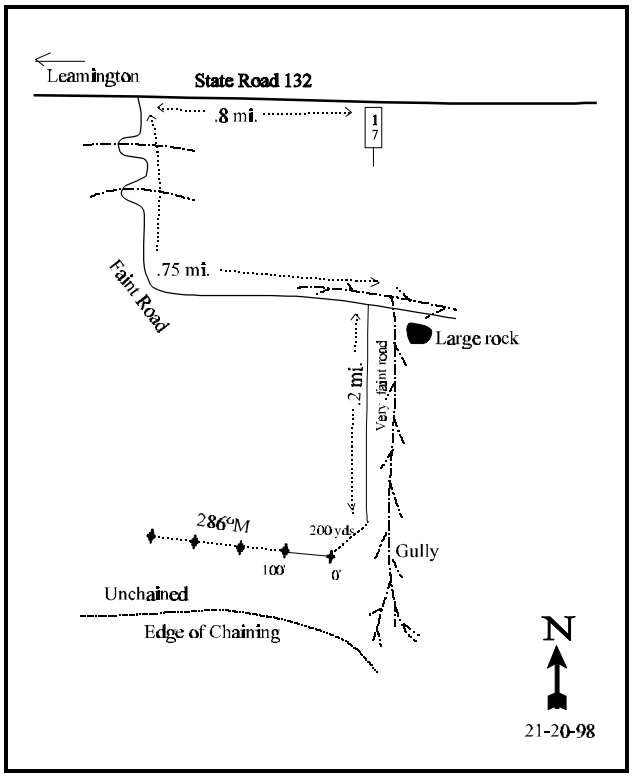
Compass bearing: Frequency baseline 286 M degrees.

First frame placement on frequency belts 5 feet. Frequency belt placement; line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft).

LOCATION DESCRIPTION

From Nephi, drive about 17.1 miles on State Road 132. Drive west 0.8 miles past mile marker 17 to a faint road on the left. Drive 0.75 miles past a water trough to a gully with a large boulder by the road. Go up the gully 0.2 miles to where it forks. Park here. The study is located on the ridge west of the gully. From the fork the study is 200 yards away by the edge of the chaining. The study is marked by 12-18 inch, green, steel fenceposts.





Map Name: Sage Valley . Diagrammatic Sketch

Township 14 S, Range 2 W, Section 7 UTM 4385967.903 N, 404471.621 E

DISCUSSION

Study No. 21-20

The Leamington Burn is a new study established in 1997 on a burned and seeded pinyon-juniper area. It occurs on BLM land about 17 miles west of Nephi and approximately one mile south of SR-132. It is part of the extensive Leamington Burn Complex that took place during the summer of 1996. The fire burned approximately 138,340 acres of mostly pinyon-juniper woodland. Rehabilitation efforts were started during the fall of 1996 that included drilling, chaining, and seeding. About 6,100 acres were treated with a rangeland drill, 10,736 acres were aerially seeded and followed by a one-way chaining with an Ely chain to help cover the seed, and 8,308 acres were aerially seeded only. This site samples a burned site that was aerially seeded and not chained. A nearby burned area that was aerially seeded then chained is sampled by study no. 21-21 to contrast the difference between the two treatments. Pellet group data indicates light use of the area by elk with 5 elk use days/acre estimated in 1998.

This site lies on a ridge that slopes gently (3% to 5%) to the southeast. Elevation is about 5,200 feet. Soil is relatively deep with an effective rooting depth estimated at 14 inches. Texture is a sandy clay loam with a neutral pH (7.0). The soil is loose and lacks structure on the surface. Rocks and pavement are common on the surface and in the profile. Some rocks under the surface have deposits of white calcium carbonate. Phosphorus in the soil may be limiting to plant growth and development at 8.0 ppm, where 10 ppm are thought to be the minimum necessary for plant development. Soil erosion is not a problem on the site due to the abundant vegetation cover and levelness of the terrain even though there is a considerable amount of bare ground (32% in 1997 down to 28% in 1998).

Prior to the fire, the site was dominated by pinyon and juniper. Currently, few remain alive. Shrubs are rare and include small numbers of sprouting species, including rubber rabbitbrush, stickyleaf low rabbitbrush, and broom snakeweed. There were a few young green ephedra sampled in 1997, but none were sampled in 1998. The majority of the vegetation cover comes from grasses and forbs which combine to produce a total of almost 13% cover in 1997, which increased to 39% by 1998. Common grasses include: cheatgrass, bluebunch wheatgrass, Indian ricegrass, and Sandberg bluegrass. Bluebunch wheatgrass is currently knee high and abundant in scattered patches. The only seeded grass that commonly occurs on this unchained site is crested wheatgrass, which had a quadrat frequency of only 4% in 1997, up to 15% by 1998. A few seeded Russian wildrye plants were also encountered in 1998. Cheatgrass is abundant and widespread. In 1997, it produced a total of 2% cover and accounted for 33% of the grass cover. It has since increased 13 fold in cover to 26% which contributes 71% of the grass cover and 66% of the total herbaceous cover on the site. It is now dense enough in some places to carry another fire. The only other grass to increase significantly in nested frequency is crested wheatgrass which still occurs in low numbers.

Forbs are diverse, but only the native Douglass chaenactis occurs more than occasionally. All forbs combined produce less than 3% cover. Seeded forbs, consisting of alfalfa and small burnet, were found on the site but in very low numbers.

1997 APPARENT TREND ASSESSMENT

The soil trend appears stable at the moment and it should improve as more vegetation becomes established in the future. Current erosion is minimal. Browse is limited to a few re-sprouting green ephedra and some broom snakeweed. The shrub trend will likely improve as more shrubs establish on the burn. The herbaceous understory is not particularly abundant at only 12% cover. The composition of grasses is good with the exception of cheatgrass which currently accounts for 33% of the grass cover. The composition of forbs is poor. The only common species include low growing native forbs and weedy annuals. Seeded forbs occur in such low numbers that they will likely not persist on this site.

1998 TREND ASSESSMENT

Trend for soil appears to be improving although a large amount of bare ground is still exposed (32% in 1997, 28% in 1998). Vegetative cover has increased 3 fold, litter cover has increased 4 fold, and rock/pavement cover has declined from 32% to 22%. Unfortunately, most of the increase in vegetation cover comes from an increase in cheatgrass. There are few shrubs on the site, yet trend is considered stable. The herbaceous understory trend is down due to a significant increase and dominance in cheatgrass. Cover of cheatgrass has increased 11 fold since 1997, and it currently accounts for 71% of the grass cover. All other grasses except crested wheatgrass, declined in nested frequency but not significantly. Crested wheatgrass increased significantly in nested frequency but it only occurs in 15% of the quadrats. Forbs are diverse with several annual and perennial species sampled but none are abundant. Cover of forbs has declined 2 fold and nested frequency has gone down 3 fold since 1997.

TREND ASSESSMENT
soil - up slightly
browse - stable, but depleted
herbaceous understory - down due to a significant increase of cheatgrass

HERBACEOUS TRENDS --
Herd unit 21 , Study no: 20

Type	Species	Nested Frequency '97	Nested Frequency '98	Quadrat Frequency '97	Quadrat Frequency '98	Average Cover % '97	Average Cover % '98
G	Agropyron cristatum	6	*35	4	15	.27	1.50
G	Agropyron elongatum	-	3	-	2	-	.04
G	Agropyron spicatum	60	41	26	19	2.20	3.90
G	Bromus tectorum (a)	153	*430	54	99	2.34	26.01
G	Elymus junceus	-	4	-	2	-	.03
G	Oryzopsis hymenoides	68	58	30	28	1.26	3.06
G	Poa secunda	63	54	25	20	.87	1.22
G	Sitanion hystrix	16	22	9	8	.17	.78
Total Annual Grasses		153	430	54	99	2.34	26.01
Total Perennial Grasses		213	217	94	94	4.79	10.56
F	Alyssum alyssoides (a)	1	2	1	1	.00	.00
F	Arabis spp.	3	-	1	-	.00	-
F	Astragalus beckwithii	4	-	2	-	.06	.00
F	Camelina microcarpa (a)	-	6	-	2	-	.06
F	Calochortus nuttallii	3	-	2	-	.01	-
F	Centaurea spp.	-	*7	-	5	-	.05
F	Chaenactis douglasii	52	42	23	15	.97	1.20
F	Crepis acuminata	-	-	-	-	-	.03
F	Descurainia pinnata (a)	14	*-	8	-	.13	-
F	Draba spp. (a)	-	*14	-	4	-	.02
F	Eriogonum cernuum (a)	6	3	2	2	.30	.03

Type	Species	Nested Frequency '97	'98	Quadrat Frequency '97	'98	Average Cover % '97	'98
F	Erigeron spp.	-	3	-	1	-	.03
F	Gilia spp. (a)	77	*-	37	-	1.64	-
F	Lactuca serriola	6	17	3	8	.61	.49
F	Lesquerella spp.	38	*-	19	-	.19	-
F	Medicago sativa	1	4	1	2	.00	.18
F	Nicotiana attenuata (a)	-	2	-	1	-	.00
F	Phlox longifolia	46	*13	22	7	.36	.03
F	Ranunculus testiculatus (a)	112	*3	34	2	.76	.03
F	Salsola iberica (a)	-	-	-	-	-	.15
F	Sanguisorba minor	1	2	1	1	.15	.15
F	Sisymbrium altissimum (a)	-	1	-	1	-	.15
F	Streptanthus cordatus	7	-	3	-	.04	-
F	Tragopogon dubius	3	3	1	2	.03	.10
Total Annual Forbs		210	31	82	13	2.83	0.44
Total Perennial Forbs		164	91	78	41	2.46	2.30

* Indicates significant difference at % = 0.10

BROWSE TRENDS --
Herd unit 21 , Study no: 20

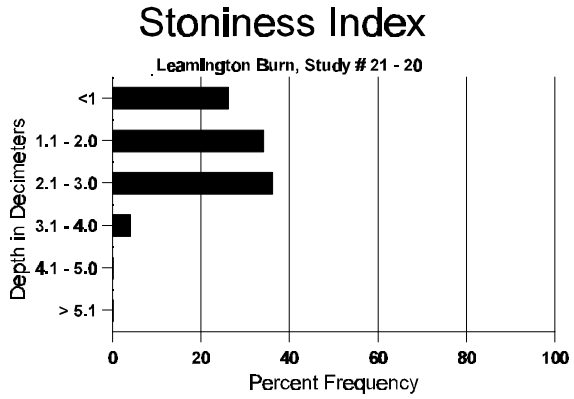
Type	Species	Strip Frequency '97	'98	Average Cover % '97	'98
B	Artemisia tridentata vaseyana	0	0	-	-
B	Chrysothamnus nauseosus albicaulis	0	1	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	0	1	.03	.15
B	Ephedra viridis	1	0	-	-
B	Gutierrezia sarothrae	3	8	.18	.86
B	Juniperus osteosperma	0	0	-	-
B	Leptodactylon pungens	-	-	.00	-
Total for Browse		4	10	0.21	1.00

BASIC COVER --
Herd unit 21 , Study no: 20

Cover Type	Nested Frequency '97	'98	Average Cover % '97	'98
Vegetation	303	444	13.11	39.16
Rock	314	251	11.08	9.00
Pavement	451	376	20.50	12.50
Litter	383	489	7.05	28.25
Cryptogams	108	9	2.08	.19
Bare Ground	424	372	32.10	28.43

SOIL ANALYSIS DATA --
Herd Unit 21, Study # 20, Study Name: Leamington Burn

Effective rooting depth (inches)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	dS/m
13.7	62.0 (13.5)	7.0	46.7	28.4	24.8	2.4	8.0	214.4	.6



PELLET GROUP FREQUENCY --
Herd unit 21 , Study no: 20

Type	Quadrat Frequency '97	'98
Rabbit	15	1
Elk	-	1
Deer	1	1
Cattle	1	-

BROWSE CHARACTERISTICS --
Herd unit 21 , Study no: 20

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Artemisia tridentata vaseyana																		
X	97	-	-	-	-	-	-	-	-	-	-	-	-	-	80			4
	98	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
% Plants Showing		Moderate Use		Heavy Use		Poor Vigor									%Change			
	'97	00%		00%		00%												
	'98	00%		00%		00%												
Total Plants/Acre (excluding Dead & Seedlings)													'97		0	Dec:		-
													'98		0			-
Chrysothamnus nauseosus albicaulis																		
Y	97	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	98	1	-	-	-	-	-	-	-	-	1	-	-	-	20			1
% Plants Showing		Moderate Use		Heavy Use		Poor Vigor									%Change			
	'97	00%		00%		00%												
	'98	00%		00%		00%												
Total Plants/Acre (excluding Dead & Seedlings)													'97		0	Dec:		-
													'98		20			-
Chrysothamnus viscidiflorus viscidiflorus																		
M	97	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	98	1	-	-	-	-	-	-	-	-	1	-	-	-	20	-	-	1
% Plants Showing		Moderate Use		Heavy Use		Poor Vigor									%Change			
	'97	00%		00%		00%												
	'98	00%		00%		00%												
Total Plants/Acre (excluding Dead & Seedlings)													'97		0	Dec:		-
													'98		20			-
Ephedra viridis																		
Y	97	3	-	-	-	-	-	-	-	-	3	-	-	-	60			3
	98	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
% Plants Showing		Moderate Use		Heavy Use		Poor Vigor									%Change			
	'97	00%		00%		00%												
	'98	00%		00%		00%												
Total Plants/Acre (excluding Dead & Seedlings)													'97		60	Dec:		-
													'98		0			-
Gutierrezia sarothrae																		
S	97	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	98	1	-	-	-	-	-	-	-	-	1	-	-	-	20			1
Y	97	1	-	-	-	-	-	-	-	-	1	-	-	-	20			1
	98	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
M	97	3	-	-	-	-	-	-	-	-	3	-	-	-	60	6	4	3
	98	12	-	-	-	-	-	-	-	-	12	-	-	-	240	12	20	12
% Plants Showing		Moderate Use		Heavy Use		Poor Vigor									%Change			
	'97	00%		00%		00%									+ 0%			
	'98	00%		00%		00%												
Total Plants/Acre (excluding Dead & Seedlings)													'97		80	Dec:		-
													'98		240			-

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Juniperus osteosperma																		
X	97	-	-	-	-	-	-	-	-	-	-	-	-	-	40			2
	98	-	-	-	-	-	-	-	-	-	-	-	-	-	20			1

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor
'97	00%	00%	00%
'98	00%	00%	00%

%Change

Total Plants/Acre (excluding Dead & Seedlings)				
	'97	0	Dec:	-
	'98	0		-

Trend Study 21-21-98

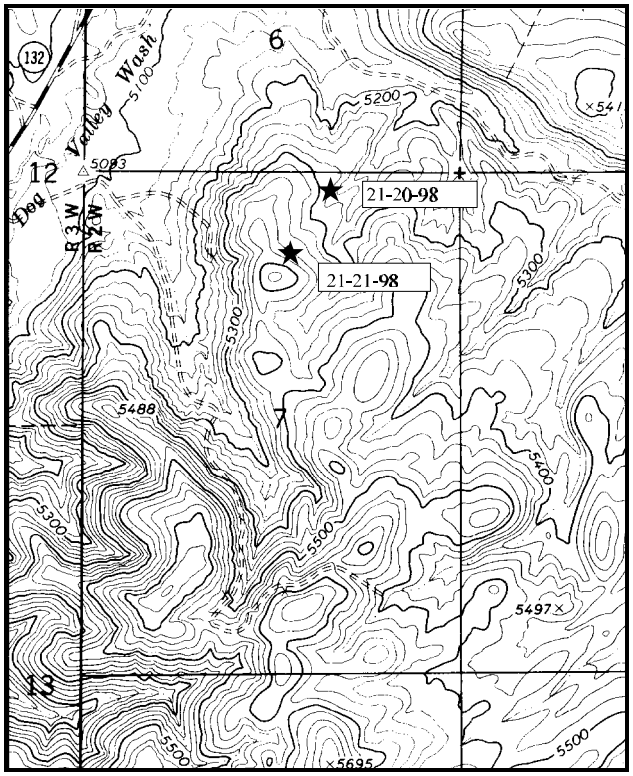
Study site name: Leamington Burn and Chain . Range Type: Chained, Burned P-J .

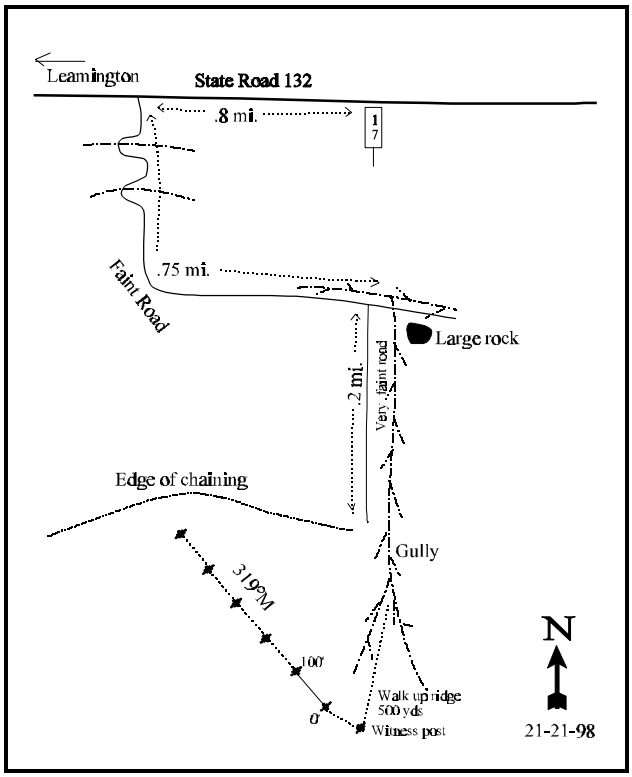
Compass bearing: frequency baseline 319 M degrees.

First frame placement on frequency belts 5 feet. Frequency belt placement; line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft).

LOCATION DESCRIPTION

From Nephi, drive about 17.1 miles on State Road 132. Drive west 0.8 miles past mile marker 17 to a faint road on the left. Drive 0.75 miles past a water trough to a gully with a large boulder by the road. Go up the gully 0 .2 miles to where it forks. Park here. From where the drainage divides in two, walk up the middle ridge about 500 yards at a bearing of 205° M to a witness post. The 0-foot stake is 20 feet from the witness post at about 319°M. The study is marked by 12-18 inch, green, steel fenceposts.





Map name: Sage Valley .

Diagrammatic Sketch

Township 14 S, Range 2 W, Section 7

UTM 4385761.607 N, 404379.844 E

DISCUSSION

Study No. 21-21

The Leamington Burn and Chain study is a new trend study established in 1997 which samples a burned, seeded, and then chained area about 500 feet west of the Leamington Burn site (# 21-20). It was established to contrast secondary succession and establishment of seeded grasses and forbs with the nearby burned and seeded treatment that made no attempt to cover the seed. The Leamington Burn & Chain site has a slope of 10% to 12% with a east-southeast aspect at an elevation of about 5,300 feet. The area burned during the summer of 1996 and is part of the previously mentioned Leamington Burn Complex (see 21-20). Seed was aerially applied and then the site was chained one-way with an Ely chain to cover the seed and enhance establishment of seeded species. The area is currently used lightly by deer and elk. Pellet group data indicate <1 deer and 1 elk use day/acre in 1997, increasing to 8 elk days use/acre by 1998. Cattle grazed the area prior to the burn, but are currently kept off to allow rehabilitated areas to recover.

Soil on the site is very similar to the Leamington burn site (# 21-20). Effective rooting depth is estimated at almost 14 inches. Rocks and pavement are abundant on the surface averaging nearly 30% cover. Rock is also common through the soil profile. Soil texture is a sandy clay loam with a neutral pH (7.0). Percent organic matter is higher compared to the burn and seeded site (3% vs 2.4%). Phosphorus is also higher at 12.3 ppm compared to 8 ppm. Percent bare ground was quite high at nearly 40% in 1997, but decreased to 27% by 1998. However, herbaceous vegetation and litter are well dispersed and erosion is not currently a problem.

Browse is limited to some seeded fourwing saltbush that was applied with a seed dribbler, and a few rubber rabbitbrush, stickyleaf low rabbitbrush, and Nevada ephedra. Broom snakeweed was the most abundant shrub in 1997 with a density of 500 plants/acre, decreasing to 400 by 1998.

Grasses and forbs combined to produced 11% cover in 1997, increasing to 31% by 1998. The most common perennial grass is crested wheatgrass which provided 43% of the grass cover in 1997, decreasing to 24% in 1998. Intermediate wheatgrass, bluebunch wheatgrass, orchard grass, and Indian ricegrass are also fairly common. Perennial grasses are very vigorous and robust with some reaching 3 to 4 feet in height. Cheatgrass also occurs on the site and accounted for 15% of the grass cover in 1997. It has increased significantly in nested frequency and now produces 10% cover which accounts for 34% of the grass cover. If one were to look only at the nested frequency value, it would appear that cheatgrass is doing almost as well on the chained site as the nearby unchained site. However, cheatgrass cover is 2½ times lower on the chained site and plants are small in stature due to the abundant and vigorous perennial grass component, not making them a fire hazard. Forbs are diverse but only produce about 2% total cover. There are several annual and native perennial species encountered. Seeded forbs, alfalfa and small burnet, occur in small numbers.

1997 APPARENT TREND ASSESSMENT

The soil trend appears stable due to the good establishment of seeded and native herbaceous species along with litter cover provided by chained dead trees. Grasses and forbs will increase in the future and provide even more soil protection. The browse trend will depend on how well the seeded fourwing saltbush becomes established. The few plants seeded around the site are vigorous and will likely increase in the future. The herbaceous understory is diverse with eight perennial grasses and 11 perennial forbs encountered. There are less annual forbs here than on the adjacent site (# 21-20). There is nothing to suggest that the herbaceous trend will not continue to improve in the future.

1998 TREND ASSESSMENT

Trend for soil is improving as more perennial vegetation becomes established on the site. Percent cover of bare ground has declined from 39% to 27%, which is still high, but erosion is not currently a problem due to

the well dispersed vegetation and litter cover. The browse trend is up slightly due to an increase in density of browse. Shrubs are still in low numbers but some fourwing saltbush and Nevada ephedra appear to be establishing. Broom snakeweed is still the most abundant shrub on the site, but density has declined slightly since 1997. Trend for the herbaceous understory is up for grasses yet down slightly for forbs. Grasses increased in cover from 9% in 1997 to 29% in 1998. Cheatgrass is the most abundant grass on the site with a significant increase in nested frequency and a 7 fold increase in cover since 1997. It currently accounts for 34% of the grass cover. However, plants are small in stature compared to the perennial grasses. The most common perennial grass, crested wheatgrass, remained at a similar frequency compared to 1997. Most of the other perennial grasses increased significantly in nested frequency. Forbs are not abundant and declined slightly in nested frequency since 1997. However, much of the change is due to several annual forbs disappearing from the site. Trend for the herbaceous understory is considered up.

TREND ASSESSMENT
soil - up
browse - up slightly, but still depleted
herbaceous understory - up, but forbs lacking

HERBACEOUS TRENDS --
Herd unit 21 , Study no: 21

Type	Species	Nested Frequency '97	Nested Frequency '98	Quadrat Frequency '97	Quadrat Frequency '98	Average Cover % '97	Average Cover % '98
G	Agropyron cristatum	144	152	57	54	3.69	6.94
G	Agropyron elongatum	39	*96	16	37	.98	4.71
G	Agropyron spicatum	27	*47	15	18	1.25	3.46
G	Bromus inermis	9	*30	3	10	.22	.73
G	Bromus tectorum (a)	98	*318	38	83	1.35	9.86
G	Dactylis glomerata	18	28	8	11	.70	.65
G	Elymus junceus	-	*22	-	9	-	.91
G	Oryzopsis hymenoides	26	28	10	15	.37	1.47
G	Poa fendleriana	4	-	2	-	.01	-
G	Poa secunda	4	*19	3	11	.06	.58
Total Annual Grasses		98	318	38	83	1.35	9.86
Total Perennial Grasses		271	422	114	165	7.31	19.47
F	Alyssum alyssoides (a)	-	2	-	1	-	.00
F	Astragalus beckwithii	3	-	1	-	.00	-
F	Astragalus calycosus	12	7	4	3	.12	.09
F	Astragalus spp.	6	6	2	3	.18	.19
F	Camelina microcarpa (a)	-	2	-	1	-	.03
F	Carduus nutans (a)	16	*-	8	-	.04	-
F	Calochortus nuttallii	-	-	-	-	.00	-
F	Chaenactis douglasii	10	10	6	4	.32	.24
F	Cryptantha spp.	1	-	1	-	.00	-
F	Descurainia pinnata (a)	-	1	-	1	-	.02

Type	Species	Nested Frequency '97	'98	Quadrat Frequency '97	'98	Average Cover % '97	'98
F	Descurainia spp. (a)	15	*-	8	-	.10	-
F	Draba spp. (a)	-	1	-	1	-	.00
F	Gilia spp. (a)	23	*-	13	-	.92	-
F	Lactuca serriola	-	*15	-	8	-	.38
F	Lesquerella spp.	5	4	3	3	.01	.16
F	Medicago sativa	1	4	1	3	.11	.29
F	Nicotiana attenuata (a)	1	-	1	-	.00	-
F	Phlox hoodii	-	1	-	1	-	.00
F	Phlox longifolia	4	-	2	-	.01	-
F	Ranunculus testiculatus (a)	7	*-	4	-	.02	-
F	Sanguisorba minor	2	3	1	2	.15	.18
F	Senecio multilobatus	-	2	-	1	-	.03
F	Streptanthus cordatus	8	*-	5	-	.02	-
Total Annual Forbs		62	6	34	4	1.08	0.05
Total Perennial Forbs		52	52	26	28	0.97	1.58

* Indicates significant difference at % = 0.10

BROWSE TRENDS --
Herd unit 21 , Study no: 21

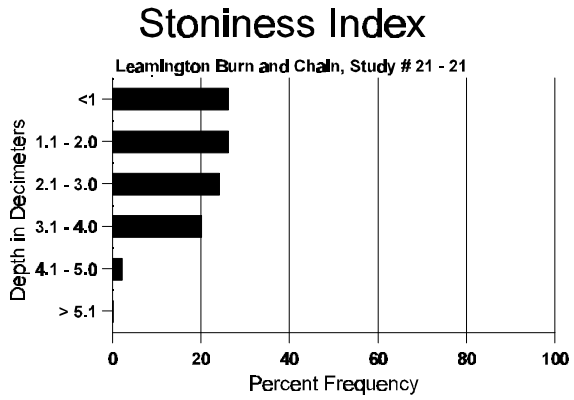
Type	Species	Strip Frequency '97	'98	Average Cover % '97	'98
B	Atriplex canescens	0	1	.03	-
B	Chrysothamnus nauseosus albicaulis	0	0	-	-
B	Chrysothamnus viscidiflorus viscidiflorus	0	1	-	-
B	Ephedra nevadensis	0	1	-	-
B	Gutierrezia sarothrae	18	11	.07	.59
B	Purshia tridentata	0	1	-	-
Total for Browse		18	15	0.10	0.59

BASIC COVER --
Herd unit 21 , Study no: 21

Cover Type	Nested Frequency '97	'98	Average Cover % '97	'98
Vegetation	257	406	10.43	34.11
Rock	372	350	16.54	20.72
Pavement	444	380	13.43	10.18
Litter	388	476	9.42	27.58
Cryptogams	45	-	1.96	0
Bare Ground	446	402	39.39	27.02

SOIL ANALYSIS DATA --
Herd Unit 21, Study # 21, Study Name: Leamington Burn and Chain

Effective rooting depth (inches)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	dS/m
13.8	62.8 (14.4)	7.0	46.0	33.1	20.9	3.0	12.3	195.2	.9



PELLET GROUP FREQUENCY --
Herd unit 21 , Study no: 21

Type	Quadrat Frequency '97	'98
Rabbit	2	3
Elk	1	4
Deer	3	-

BROWSE CHARACTERISTICS --
Herd unit 21 , Study no: 21

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Atriplex canescens																		
S	97	1	-	-	-	-	-	-	-	-	1	-	-	-	20			1
	98	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
M	97	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	98	1	-	-	-	-	-	-	-	-	1	-	-	-	20	34	41	1

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor
'97	00%	00%	00%
'98	00%	00%	00%

%Change

Total Plants/Acre (excluding Dead & Seedlings)				
'97	0	Dec:	-
'98	20		-

Chrysothamnus nauseosus albicaulis																		
M	97	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	98	-	-	-	-	-	-	-	-	-	-	-	-	-	0	23	20	0

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor
'97	00%	00%	00%
'98	00%	00%	00%

%Change

Total Plants/Acre (excluding Dead & Seedlings)			
'97	0	Dec:	-
'98	0		-

Chrysothamnus viscidiflorus viscidiflorus																		
Y	97	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	98	1	-	-	-	-	-	-	-	-	-	-	1	-	20			1

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor
'97	00%	00%	00%
'98	00%	00%	100%

%Change

Total Plants/Acre (excluding Dead & Seedlings)			
'97	0	Dec:	-
'98	20		-

Ephedra nevadensis																		
Y	97	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	98	1	-	-	-	-	-	-	-	-	1	-	-	-	20			1
M	97	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	98	-	-	-	-	-	-	-	-	-	-	-	-	-	0	16	22	0

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor
'97	00%	00%	00%
'98	00%	00%	00%

%Change

Total Plants/Acre (excluding Dead & Seedlings)			
'97	0	Dec:	-
'98	20		-

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Gutierrezia sarothrae																		
S	97	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	98	1	-	-	-	-	-	-	-	-	1	-	-	-	20			1
M	97	23	-	-	-	-	-	-	-	-	23	-	-	-	460	6	6	23
	98	20	-	-	-	-	-	-	-	-	20	-	-	-	400	12	18	20

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor	%Change
'97	00%	00%	00%	-78%
'98	00%	00%	00%	

Total Plants/Acre (excluding Dead & Seedlings)				
'97	460	Dec:	-	
'98	400		-	

Purshia tridentata																		
Y	97	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	98	1	-	-	-	-	-	-	-	-	1	-	-	-	20			1

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor	%Change
'97	00%	00%	00%	
'98	00%	00%	00%	

Total Plants/Acre (excluding Dead & Seedlings)			
'97	0	Dec:	-
'98	20		-

SUMMARY

Site Comparisons between Leamington Burn & Seed 21-20 and Leamington Burn and Chain 21-21

1997 Comparisons

Basic ground cover characteristics are similar between the two sites but some slight differences are apparent. Vegetation cover is slightly higher on the unchained site. However, this is due primarily to the abundance of cheatgrass and annual forbs which are over two times more abundant and produced 4 times more cover here compared to the chained site. Litter cover is higher (7% vs 10%) on the chained site due in part to the presence of chained tree cover lying on the ground. This provides better soil protection than dead standing snags.

The chaining treatment provided for better seeded grass establishment. Seeded species, crested wheatgrass, intermediate wheatgrass, and orchard grass have a 35 times higher sum of nested frequency compared to the burn and seeded site. In contrast, native grasses established better on the unchained treatment where they were found to be three times higher in nested frequency. Unfortunately, the unchained site also provided a better environment for cheatgrass and weedy annual forbs to become established. Native species do not compete very well against cheatgrass. Cheatgrass is nearly twice as abundant and produces almost two times more cover on the unchained site while annual forbs are more than three times more abundant and produce twice as much cover.

Both sites had nearly identical low frequencies of the seeded forbs alfalfa and small burnet. From these preliminary findings, seeded grasses and forbs did not successfully establish on the unchained site after one growing season. In addition, seeded forbs did not establish well on the chained treatment. More data will need to be collected over several years to determine if these preliminary findings remain consistent.

1998 Comparison

Ground cover characteristics are very similar between sites with the only differences being slightly more vegetation cover and less rock cover on the unchained site. Erosion is not a problem on either site.

Shrubs are lacking on the unchained site. The few Nevada ephedra encountered in 1997 were not found in 1998. The chained site shows some establishment of the seeded shrub, fourwing saltbush. However, density is minimal at only 20 plants/acre. A few Nevada ephedra and bitterbrush were also picked up in 1998. Broom snakeweed is found in low densities on both sites, but density has declined from 500 to 400 plants/acre on the chained site while density has increased from 60 to 240 plants/acre on the unchained site. The chained site displayed a significant increase in the nested frequency of all but three grasses. Sum of nested frequency of perennial grasses increased from 271 to 422. Cover increased nearly 3 fold from 7% to 20%. Sum of nested frequency of perennial grasses on the unchained site remained similar (213 to 217) and cover increased from 5% to 11%. Cheatgrass dominates the herbaceous understory on the unchained site. Cover has increased 13 fold since 1997 from 2% to 26%. It currently provides 71% of the grass cover and 66% of the herbaceous cover. This is an increase from 1997 when cheatgrass accounted for only 33% of the grass cover. The chained site has a high nested frequency value for cheatgrass at 318 and cover has increased from 1.4% to 10%. However, cheatgrass cover is 2.6 times lower than the unchained site due to competition with perennial grasses. It is apparent that the only way to control cheatgrass on rehabilitation projects such as this is to make sure that perennial grasses become established in sufficient numbers so they can compete with the weedy species.

Forb composition is similar between sites. Seeded forbs occur at similarly low frequencies. Total forb cover is higher on the unchained site due to the presence of high numbers of weedy biennial and annual forbs. This is likely a function of the lack of competition with perennial grasses.